

WHAT IS CLAIMED IS:

1. An apparatus for controlling a stepping motor, comprising:

synchronous signal generating means for generating
5 a synchronous signal having a period corresponding to N
(natural number) times of one-line of an image;

line trigger producing means for producing N (in
number) line triggers in synchronous with generation of
the synchronous signal;

10 a motor control unit for controlling said stepping
motor; and

a CPU for controlling said motor control unit in
synchronous with the generation of the synchronous
signal,

15 wherein said motor control unit effects motor
control until at least next synchronous signal is
reached on the basis of the line triggers.

2. A stepping motor controlling apparatus
20 according to claim 1, wherein said motor control unit
includes first memory means for holding timer data for
advancing a phase of said stepping motor and second
memory means for holding the number of steps of the
timer data, and said stepping motor is controlled on
25 the basis of the timer data and the number of steps.

3. A stepping motor controlling apparatus

according to claim 2, wherein said motor control unit is synchronized with the line triggers produced by said producing means and controls acceleration/deceleration of said stepping motor by switching

5 acceleration/deceleration data tables comprised of the timer data and the number of steps.

4. An apparatus for controlling a stepping motor, comprising:

10 synchronous signal generating means for generating a synchronous signal for synchronizing with a motor control unit;

a motor control unit for controlling said stepping motor; and

15 a CPU for controlling said motor control unit; and line trigger producing means for producing N (in number) line triggers,

wherein said motor control unit has a synchronous mode for controlling said stepping motor in synchronous with generation of the synchronous signal and a non-synchronous mode for controlling said stepping motor regardless of the generation of the synchronous signal,

20 when the synchronous mode is selected, the motor control synchronous with the synchronous signal is effected, and

25 when the non-synchronous mode is set, said line trigger producing means generates line triggers which

are not synchronous with the synchronous signal and said motor control unit controls said motor on the basis of the line triggers which are not synchronous with the synchronous signal.

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5. A stepping motor controlling apparatus according to claim 4, wherein said synchronous signal generating means generates the synchronous signal having a period corresponding to N (natural number) times of one-line of an image, and, when the synchronous mode is selected, said line trigger producing means produces the line trigger synchronous with the synchronous signal and said motor control unit effects motor control until at least next synchronous signal is reached on the basis of the line trigger synchronous with the synchronous signal.

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6. A stepping motor controlling apparatus according to claim 4, wherein said motor control unit includes first memory means for holding timer data for advancing a phase of said stepping motor and second memory means for holding the number of steps of the timer data, and said stepping motor is controlled on the basis of the timer data and the number of steps.

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7. A stepping motor controlling apparatus according to claim 6, wherein said motor control unit

is synchronized with the line triggers produced by said
producing means and controls acceleration/deceleration
of said stepping motor by switching
acceleration/deceleration data tables comprised of the
5 timer data and the number of steps.

8. A stepping motor controlling apparatus
according to claim 4 or 5, wherein the synchronous mode
is selected in case of an image having great memory
10 usage amount and the non-synchronous mode is selected
in case of an image having small memory usage amount.

9. A stepping motor controlling apparatus
according to claim 4 or 5, wherein the synchronous mode
15 is selected in case of a color image and the non-
synchronous mode is selected in case of a monochromatic
image.

10. An apparatus for reading an image,
20 comprising:
reading means for reading an image with line unit;
storing means for storing the read image;
synchronous signal generating means for generating
a synchronous signal having a period corresponding to N
25 (natural number) times of one-line of the image;
line trigger producing means for producing N (in
number) line triggers in synchronous with generation of

the synchronous signal;

a motor control unit for effecting
acceleration/deceleration control of said stepping
motor on the basis of the line triggers;

5 a CPU for controlling said motor control unit in
synchronous with the generation of the synchronous
signal;

judging means for judging a usage state of said
storing means; and

10 stop control means for causing said CPU to effect
control for stopping said motor with respect to said
motor control unit in synchronous with the generation
of the synchronous signal when said judge means judges
that vacant capacity of said storing means is smaller
15 than a predetermined value or that usage amount of said
storing means is smaller than a predetermined value,

wherein said motor control unit effects stop
control for decelerating and stopping said motor on the
basis of the line triggers by means of said stop
20 control means.

11. An image reading apparatus according to claim
10, wherein said judging means includes reading re-
start instructing means for instructing re-start of
25 reading when it is judged that the vacant capacity of
said storing means is greater than the predetermined
value.

12. An image reading apparatus according to claim 10, wherein, when said reading re-start instructing means instructs the re-start of reading in synchronous with the generation of the synchronous signal, said
5 motor control unit accelerates said motor to reversely rotate said motor up to a position sufficient to effect fixed speed driving to a deceleration starting position from which deceleration is started by the stop instruction, thereby permitting the re-start of reading
10 at a high speed again.

13. An image reading apparatus according to claim 10, wherein said motor control portion has a synchronous mode for controlling said stepping motor in
15 synchronous with the generation of the synchronous signal and a non-synchronous mode for controlling said stepping motor regardless of the generation of the synchronous signal, and when the non-synchronous mode is selected, said line trigger producing means
20 generates the N (in number) line triggers regardless of the generation of the synchronous signal and said motor control unit controls said motor on the basis of the N line triggers which are not synchronous with the synchronous signal.

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14. An image reading apparatus according to claim 13, wherein the synchronous mode is selected in case of

an image having great memory usage amount and the non-synchronous mode is selected in case of an image having small memory usage amount.

5 15. An image reading apparatus according to claim 13, wherein the synchronous mode is selected in case of a color image and the non-synchronous mode is selected in case of a monochromatic image.

10 16. An apparatus for controlling a stepping motor, comprising:

 synchronous signal generating means for generating a synchronous signal having a period corresponding to N (natural number) times of one-line of an image;

15 line trigger producing means for producing N (in number) line triggers in synchronous with generation of the synchronous signal;

 a motor control unit for controlling said stepping motor; and

20 instruction receiving means for receiving a motor control instruction from a CPU in synchronous with the generation of the synchronous signal,

 wherein said motor control unit effects motor control until at least next synchronous signal is
25 reached on the basis of the line triggers.

17. A stepping motor controlling apparatus

according to claim 16, wherein said motor control unit includes first memory means for holding timer data for advancing a phase of said stepping motor and second memory means for holding the number of steps of the timer data, and said stepping motor is controlled on the basis of the timer data and the number of steps.

18. A stepping motor controlling apparatus according to claim 17, wherein said motor control unit is synchronized with the line triggers produced by said producing means and controls acceleration/deceleration of said stepping motor by switching acceleration/deceleration data tables comprised of the timer data and the number of steps.

19. An apparatus for controlling a stepping motor, comprising:

synchronous signal receiving means for receiving a synchronous signal for synchronizing with a motor

control unit;

a motor control unit for controlling said stepping motor;

instruction receiving means for receiving motor control instruction from a CPU; and

line trigger producing means for producing line triggers at a period corresponding to one line of an image,

wherein said motor control unit has a synchronous mode for controlling said stepping motor in synchronous with receipt of the synchronous signal and a non-synchronous mode for controlling said stepping motor regardless of receipt of the synchronous signal,

when the synchronous mode is selected, said instruction receiving means receives the motor control instruction from said CPU in synchronous with generation of the synchronous signal and said motor control unit effects motor control on the basis of the instruction received by said instruction receiving means, and

when the non-synchronous mode is set, said line trigger producing means produces line triggers which are not synchronous with the synchronous signal and said motor control unit effects the motor control on the basis of the line triggers which are not synchronous with the synchronous signal.

20. A stepping motor controlling apparatus according to claim 19, wherein said synchronous signal receiving means receives the synchronous signal having a period corresponding to N (natural number) times of one-line of the image, and wherein, when the synchronous mode is selected, said line trigger producing means produces a line trigger which is synchronous with the synchronous signal and said motor

control unit effects the motor control until at least next synchronous signal is reached on the basis of the line trigger which is synchronous with the synchronous signal.

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21. A stepping motor controlling apparatus according to claim 19, wherein said motor control unit includes first memory means for holding timer data for advancing a phase of said stepping motor and second
10 memory means for holding the number of steps of the timer data, and said stepping motor is controlled on the basis of the timer data and the number of steps.

22. A stepping motor controlling apparatus
15 according to claim 21, wherein said motor control unit is synchronized with the line triggers produced by said producing means and controls acceleration/deceleration of said stepping motor by switching
acceleration/deceleration data tables comprised of the
20 timer data and the number of steps.

23. A stepping motor controlling apparatus according to claim 19, wherein the synchronous mode is
25 selected in case of an image having great memory usage amount and the non-synchronous mode is selected in case of an image having small memory usage amount.

24. A stepping motor controlling apparatus according to claim 19, wherein the synchronous mode is selected in case of a color image and the non-synchronous mode is selected in case of a monochromatic image.

25. A stepping motor controlling apparatus according to claim 1, 4, 16 or 19, wherein said motor control unit includes PWM output data storing means for holding PWM output data having a predetermined the number of bits for determining an exciting current for said stepping motor, and PWM output means for outputting the PWM data stored in said PWM output data storing means in synchronous with a phase of said stepping motor, and wherein said stepping motor is controlled by setting the number of bits of the PWM data outputted from said PWM output means.

26. An image reading apparatus according to claim 10, wherein said motor control unit includes PWM output data storing means for holding PWM output data having a predetermined the number of bits for determining exciting current for said stepping motor, and PWM output means for outputting the PWM data stored in said PWM output data storing means in synchronous with a phase of said stepping motor, and wherein said stepping motor is controlled by setting the number of bits of

the PWM data outputted from said PWM output means.

27. A stepping motor controlling apparatus according to claim 3, 7, 18 or 22, wherein said motor control unit includes step-up or step-down number storing means for holding a step-up number or a step-down number of said acceleration/deceleration table, and step-up or step-down of said acceleration/deceleration table is effected on the basis of the step-up number or the step-down number held by said step-up or step-down number storing means.

28. A stepping motor controlling apparatus according to claim 26, wherein said motor control unit includes table number storing means for holding a table number of acceleration/deceleration tables, and step-up or step-down of said acceleration/deceleration table is stopped on the basis of the table number held by said table number storing means.

29. A method for controlling a stepping motor, comprising the steps of:

generating a synchronous signal having a period corresponding to N (natural number) times of one-line of an image;

producing N (in number) line triggers in synchronous with generation of the synchronous signal;

controlling said stepping motor by means of a
motor control unit; and

controlling said motor control unit in synchronous
with the generation of the synchronous signal by a CPU,

5 wherein said motor control unit effects motor
control unit at least next synchronous signal is
reached on the basis of the line triggers.

10 30. A stepping motor controlling method according
to claim 29, wherein said motor control unit includes
first memory means for holding timer data for advancing
a phase of said stepping motor and second memory means
for holding the number of steps of the timer data, and
15 said stepping motor is controlled on the basis of the
timer data and the number of steps.

20 31. A stepping motor controlling method according
to claim 30, wherein said motor control unit is
synchronized with the line triggers and controls
acceleration/deceleration of said stepping motor by
switching acceleration/deceleration data tables
comprised of the timer data and the number of steps.

25 32. A method for controlling a stepping motor,
comprising the steps of:

generating a synchronous signal for synchronizing
with a motor control unit by synchronous signal

generating means;

controlling said stepping motor by means of said motor control unit; and

controlling said motor control unit by a CPU; and
5 producing N (in number) line triggers by line trigger producing means,

wherein said motor control unit has a synchronous mode for controlling said stepping motor in synchronous with generation of the synchronous signal and a non-
10 synchronous mode for controlling said stepping motor regardless of the generation of the synchronous signal,

when the synchronous mode is selected, the motor control synchronous with the synchronous signal is effected, and

15 when the non-synchronous mode is set, said line trigger producing means generates line triggers which are not synchronous with the synchronous signal and said motor control unit controls said motor on the basis of the line triggers which are not synchronous
20 with the synchronous signal.

33. A stepping motor controlling method according to claim 32, wherein said synchronous signal generating means generates the synchronous signal having a period
25 corresponding to N (natural number) times of one-line of an image, and, when the synchronous mode is selected, said line trigger producing means produces

the line trigger synchronous with the synchronous
signal and said motor control unit effects motor
control until at least next synchronous signal is
reached on the basis of the line trigger synchronous
5 with the synchronous signal.

34. A stepping motor controlling method according
to claim 32, wherein said motor control unit includes
first memory means for holding timer data for advancing
10 a phase of said stepping motor and second memory means
for holding the number of steps of the timer data, and
said stepping motor is controlled on the basis of the
timer data and the number of steps.

35. A stepping motor controlling method according
to claim 34, wherein said motor control unit is
synchronized with the line triggers produced by said
producing means and controls acceleration/deceleration
of said stepping motor by switching
15 acceleration/deceleration data tables comprised of the
timer data and the number of steps.

36. A stepping motor controlling method according
to claim 32 or 33, wherein the synchronous mode is
25 selected in case of an image having great memory usage
amount and the non-synchronous mode is selected in case
of an image having small memory usage amount.

37. A stepping motor controlling method according to claim 32 or 33, wherein the synchronous mode is selected in case of a color image and the non-synchronous mode is selected in case of a monochromatic image.

38. A method for reading an image, comprising the steps of:

reading an image with line unit;

storing the read image by storing means;

generating a synchronous signal having a period corresponding to N (natural number) times of one-line of the image;

producing N (in number) line triggers in synchronous with generation of the synchronous signal by line trigger producing means;

effecting acceleration/deceleration control of said stepping motor on the basis of the line triggers by means of a motor control unit;

controlling said motor control unit in synchronous with the generation of the synchronous signal;

judging a usage state of said storing means by means of judging means; and

causing said CPU to effect control for stopping said motor with respect to said motor control unit in synchronous with the generation of the synchronous signal when it is judged that vacant capacity of said

storing means is smaller than a predetermined value or that usage amount of said storing means is smaller than a predetermined value, by means of stop control means,

wherein said motor control unit effects stop
5 control for decelerating and stopping said motor on the basis of the line triggers by means of said stop control means.

39. An image reading method according to claim
10 38, wherein said judging means includes reading re-start instructing means for instructing re-start of reading when it is judged that the vacant capacity of said storing means is greater than the predetermined value.

40. An image reading method according to claim
15 38, wherein, when said reading re-start instructing means instructs the re-start of reading in synchronous with the generation of the synchronous signal, said
20 motor control unit accelerates said motor to reversely rotate said motor up to a position sufficient to effect fixed speed driving to a deceleration starting position from which deceleration is started by the stop
instruction, thereby permitting the re-start of reading
25 at a high speed again.

41. An image reading method according to claim

38, wherein said motor control unit has a synchronous mode for controlling said stepping motor in synchronous with the generation of the synchronous signal and a non-synchronous mode for controlling said stepping motor regardless of the generation of the synchronous signal, and when the non-synchronous mode is selected, said line trigger producing means generates the N (in number) line triggers regardless of the generation of the synchronous signal and said motor control unit controls said motor on the basis of the N line triggers which are not synchronous with the synchronous signal.

42. An image reading method according to claim 41, wherein the synchronous mode is selected in case of an image having great memory usage amount and the non-synchronous mode is selected in case of an image having small memory usage amount.

43. An image reading method according to claim 41, wherein the synchronous mode is selected in case of a color image and the non-synchronous mode is selected in case of a monochromatic image.

44. A method for controlling a stepping motor, comprising the steps of:

generating a synchronous signal having a period corresponding to N (natural number) times of one-line

of an image;

producing N (in number) line triggers in
synchronous with generation of the synchronous signal;

controlling said stepping motor by means of a
5 motor control unit; and

receiving a motor control instruction from a CPU
in synchronous with the generation of the synchronous
signal by instructing receiving means,

wherein said motor control unit effects motor
10 control until at least next synchronous signal is
reached on the basis of the line triggers.

45. A stepping motor controlling method according
to claim 44, wherein said motor control unit includes
15 first memory means for holding timer data for advancing
a phase of said stepping motor and second memory means
for holding the number of steps of the timer data, and
said stepping motor is controlled on the basis of the
timer data and the number of steps.

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46. A stepping motor controlling method according
to claim 45, wherein said motor control unit is
synchronized with the line triggers produced by said
producing means and controls acceleration/deceleration
25 of said stepping motor by switching
acceleration/deceleration data tables comprised of the
timer data and the number of steps.

47. A methods for controlling a stepping motor,
comprising the steps of:

receiving a synchronous signal for synchronizing
with a motor control unit;

5 controlling said stepping motor by means of said
motor control unit;

receiving motor control instruction from a CPU by
means of instruction receiving means; and

10 producing line triggers at a period corresponding
to one line of an image by means of line trigger
producing means,

wherein said motor control unit has a synchronous
mode for controlling said stepping motor in synchronous
with receipt of the synchronous signal and a non-
15 synchronous mode for controlling said stepping motor
regardless of receipt of the synchronous signal,

when the synchronous mode is selected, said
instruction receiving means receives the motor control
instruction from said CPU in synchronous with
20 generation of the synchronous signal and said motor
control unit effects motor control on the basis of the
instruction received by said instruction receiving
means, and

when the non-synchronous mode is set, said line
25 trigger producing means produces line triggers which
are not synchronous with the synchronous signal and
said motor control unit effects the motor control on

the basis of the line triggers which are not synchronous with the synchronous signal.

48. A stepping motor controlling method according to claim 47, wherein said synchronous signal receiving means receives the synchronous signal having a period corresponding to N (natural number) times of one-line of the image, and wherein, when the synchronous mode is selected, said line trigger producing means produces a line trigger which is synchronous with the synchronous signal and said motor control unit effects the motor control until at least next synchronous signal is reached on the basis of the line trigger which is synchronous with the synchronous signal.

49. A stepping motor controlling method according to claim 47, wherein said motor control unit includes first memory means for holding timer data for advancing a phase of said stepping motor and second memory means for holding the number of steps of the timer data, and said stepping motor is controlled on the basis of the timer data and the number of steps.

50. A stepping motor controlling method according to claim 49, wherein said motor control unit is synchronized with the line triggers produced by said producing means and controls acceleration/deceleration

of said stepping motor by switching
acceleration/deceleration data tables comprised of the
timer data and the number of steps.

5 51. A stepping motor controlling method according
to claim 47, wherein the synchronous mode is selected
in case of an image having great memory usage amount
and the non-synchronous mode is selected in case of an
image having small memory usage amount.

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52. A stepping motor controlling method according
to claim 47, wherein the synchronous mode is selected
in case of a color image and the non-synchronous mode
is selected in case of a monochromatic image.

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53. A stepping motor controlling method according
to claim 29, 32, 44 or 47, wherein said motor control
unit includes PWM output data storing means for holding
PWM output data having a predetermined the number of
20 bits for determining an exciting current for said
stepping motor, and PWM output means for outputting the
PWM data stored in said PWM output data storing means
in synchronous with a phase of said stepping motor, and
wherein said stepping motor is controlled by setting
25 the number of bits of the PWM data outputted from said
PWM output means.

54. An image reading method according to claim
38, wherein said motor control unit includes PWM output
data storing means for holding PWM output data having a
predetermined the number of bits for determining
5 exciting current for said stepping motor, and PWM
output means for outputting the PWM data stored in said
PWM output data storing means in synchronous with a
phase of said stepping motor, and wherein said stepping
motor is controlled by setting the number of bits of
10 the PWM data outputted from said PWM output means.

55. A stepping motor controlling method according
to claim 31, 35, 46 or 50, wherein said motor control
unit includes step-up or step-down number storing means
15 for holding a step-up number or a step-down number of
said acceleration/deceleration table, and step-up or
step-down of said acceleration/deceleration table is
effected on the basis of the step-up number or the
step-down number held by said step-up or step-down
20 number storing means.

56. A stepping motor controlling method according
to claim 54, wherein said motor control unit includes
table number storing means for holding a table number
25 of acceleration/deceleration tables, and step-up or
step-down of said acceleration/deceleration table is
stopped on the basis of the table number held by said
table number storing means.